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Waste Minimization and Pollution Prevention

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Waste Minimization and Pollution Prevention*

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* **Editorial revision**

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Waste Minimization and Pollution Prevention

1.0 Introduction

Prior to 1990, industrial waste and discharges were treated at the “end of the pipe.” Solid and liquid wastes were collected, then treated and discharged to the air or sewer or sent to a landfill for disposal. Since 1990, LLNL has been increasing the use of pollution prevention measures to reduce or eliminate the generation of waste and toxic emissions at the point of generation instead of at the “end of the pipe.” Our efforts have been consistent with federal, state, and local laws, regulations, and guidelines. The established U.S. Environmental Protection Agency (EPA) environmental protection hierarchy, given in order of preference, is: source reduction, recycling, treatment, then disposal.

As stated, it is the policy of EPA to first prevent or reduce pollution at the source, whenever feasible. Feasibility is determined by the requirements of applicable laws, the level of risk reduction that can be achieved, and cost-effectiveness. EPA’s policy has led to the development of federal and state guidelines and regulations to ensure the proper handling, minimization, and disposal of solid waste. The U.S. Department of Energy’s (DOE’s) version of the EPA policy institutes pollution prevention programs that place specific evaluation, reduction, and reporting requirements on facilities that generate hazardous and mixed radioactive, and nonhazardous solid waste. “Nonhazardous solid waste” means solid or liquid wastes, including garbage, trash, refuse, paper rubbish, food, sludge; industrial, demolition, and construction wastes; or any other nonhazardous discarded material.

Because of the size and nature of its operations, the Lawrence Livermore National Laboratory (LLNL) generates large volumes of hazardous, radioactive, and nonhazardous solid waste. Programs for managing and disposing of these types of waste have been developed with two primary goals in mind: resource conservation and environmentally sound management practices.

Integration of pollution prevention strategies into program planning, procurements, operations, and even decommissioning and demolition activities helps LLNL demonstrate its commitment to keep waste volumes and regulated emissions as low as technically and economically feasible.

1.1 Regulatory Summary

A number of important federal and state mandates addressing pollution prevention, including executive orders, federal and state laws and regulations, and DOE orders, are applicable to LLNL research activities and operations. Descriptions of these can be found in Appendix A.

2.0 Applicability to LLNL Activities

LLNL must prepare and submit waste minimization and pollution prevention documentation, as required by DOE Order 5400.1, Chapter III, Paragraphs 4(b) and 4(c), Pollution Prevention and Waste Minimization.

Additionally, LLNL is subject to the waste minimization requirements established by Executive Order 13101 [Greening the Government through Waste Prevention, Recycling, and Federal Acquisition (Sept. 14, 1998)]; Resource Conservation and Recovery Act (RCRA) Subtitles D and F; and state and local ordinances; as well as University of California (UC) contract performance measures for routine operations at LLNL.

DOE did not establish 1999 quantitative goals for nonroutine waste, but these waste streams are included in the prioritization of LLNL waste streams for pollution prevention/waste minimization activities and goals for nonroutine waste are expected to be included in the DOE 2004 quantitative goals.

LLNL prioritizes waste streams based not only on quantity; relative cost of compliance and waste management, future liability, toxicity, and public perception are used in the prioritization for pollution prevention.

In 1997, approximately 70% of the waste generated was nonroutine, i.e., waste that was not produced from routine operations. In 1997, the top three prioritized waste streams were nonroutine and there were four more nonroutine waste streams in the top 20 prioritized waste stream list. Thus, in addition to concentrating on pollution prevention activities for routine waste, LLNL also is addressing the generation of nonroutine waste, much of which is the result of remediation activities: building construction, renovation, and decontamination and demolition.

The performance measures goals that are applicable to operations at LLNL as part of the UC contract with DOE are located online at

http://labs.ucop.edu/internet/comix/

Because LLNL is a hazardous waste generator subject to federal and state hazardous waste requirements, it must comply with regulations that require transportation manifests, biennial reports, and Senate Bill (SB) 14 reports and plans. As a federal facility, LLNL is also required to submit a Form R on an annual basis to the EPA. Descriptions of these reports and forms can be found in Appendix A.

Locally, LLNL assists Alameda County in proactive efforts to recover wastes for reuse, recycling, and economic value. In doing so, LLNL has implemented and continues to refine a successful waste minimization program. It will be difficult to sustain significant cost-effective improvements in nonhazardous waste reduction in the future because of the past accomplishments.

The preferred method of waste minimization is source reduction, followed by reuse, recycling, and then treatment. If these are unattainable, then proper disposal is the final option. Figure 1 shows the two top methods of waste minimization: source reduction and recycling and their respective potential waste minimization methods.

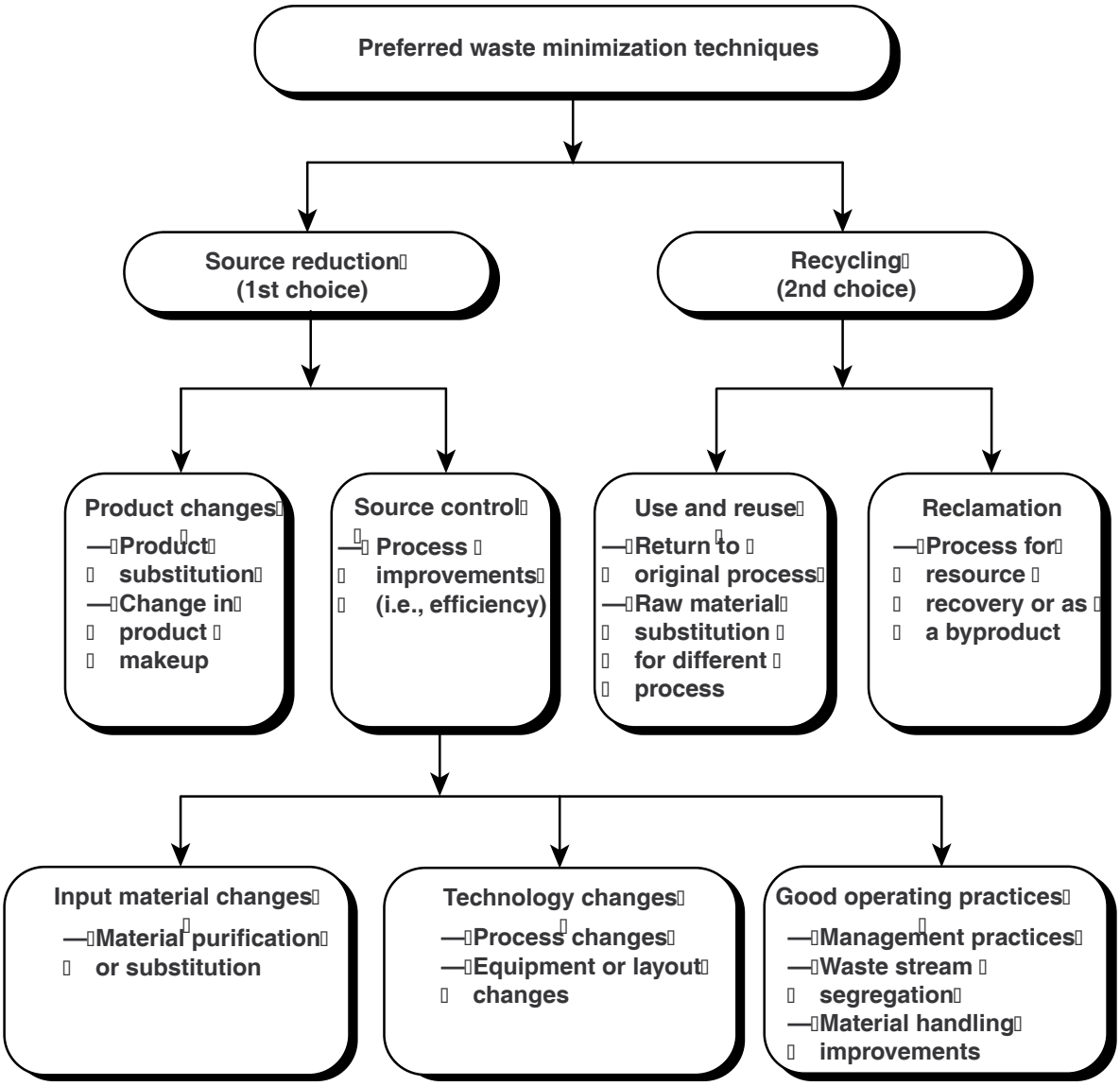

Figure 1. Preferred waste minimization techniques.

Source reduction is the technique of modifying industrial processes, experiments, and everyday activities so that the volume or toxicity of a waste is reduced or eliminated at the source. For example, nontoxic water-based solvents might be suitable substitutes for volatile organic solvents. As another illustration, more durable materials may be purchased that, although more expensive, will last longer and reduce the frequency of disposal and overall costs.

In California, **recycling** is defined as “the process by which salvaged materials become reusable products.” Recycling can be considered reuse, where materials are used again in the same process or a similar process, or can involve reclamation, where materials are processed for resource recovery or as a byproduct. Recycling often involves physically changing the waste material before it can be reused. Waste paper, newspapers, cardboard, scrap metals, beverage containers, tires, and wood are all recyclable materials. Each of these wastes is easily recycled for its value as a reusable resource. Recycling reduces the demand for new (virgin) products, saving both purchasing and disposal and landfill space. Examples include closed-loop recycling of filtered solvents, the use of concrete blocks for soil erosion control, and the reuse of cardboard boxes in packing.

Compliance with waste minimization regulations generally consists of developing and implementing a viable recycling and waste reduction program. Currently there are mandated reporting requirements associated with federal or state regulations and UC contract performance measures. For example, DOE requires periodic reporting on the status of DOE facility solid waste minimization and management programs. For these reasons, it is important for waste generators to use accurate and consistent descriptions of their waste types and volumes when filling out waste requisitions and maintaining records.

Employees can help LLNL minimize nonhazardous solid wastes generated by participating in the following existing or proposed programs:

- **Recycling and recovery of scrap metals and other materials.** LLNL’s Donation, Utilization, and Sales (DUS) accepts, stores, and sells ferrous and nonferrous metals, tires, precious metals, and reassigned equipment. DUS also operates several reuse initiatives, such as moving box and pallet reuse. In FY97, LLNL received a national DOE award for its achievements in solid waste recycling.
- **Waste office paper collection and recycling.** This very successful effort uses the combined efforts of LLNL staff, the onsite janitorial service, and a recycling contractor to accumulate and collect this high-volume waste stream.
- **Cardboard collection and recycling at high-volume generation points.** Waste cardboard is collected sitewide and sold to an offsite recycler.
- **An active affirmative procurement program.** This program purchases raw materials and products (i.e., office paper and supplies, reconditioned toner cartridges, paper towels) that are made with postconsumer, or recycled, content.
- **Education and awareness programs for LLNL personnel.** This active program solicits participation in recycling activities through newsletters, publications, presentations, web sites, e-mail, Earth Day, and other publicity programs.
- **Compost program for landscaping wastes.** LLNL has set aside an open area for accumulation and composting of organic materials (i.e., grass clippings, weeds, tree trimmings, and other “green wastes”). The compost is then utilized as an onsite soil amendment versus buying compost.

Figure 2 illustrates some of the types of nonhazardous solid wastes that can be minimized through established LLNL programs.

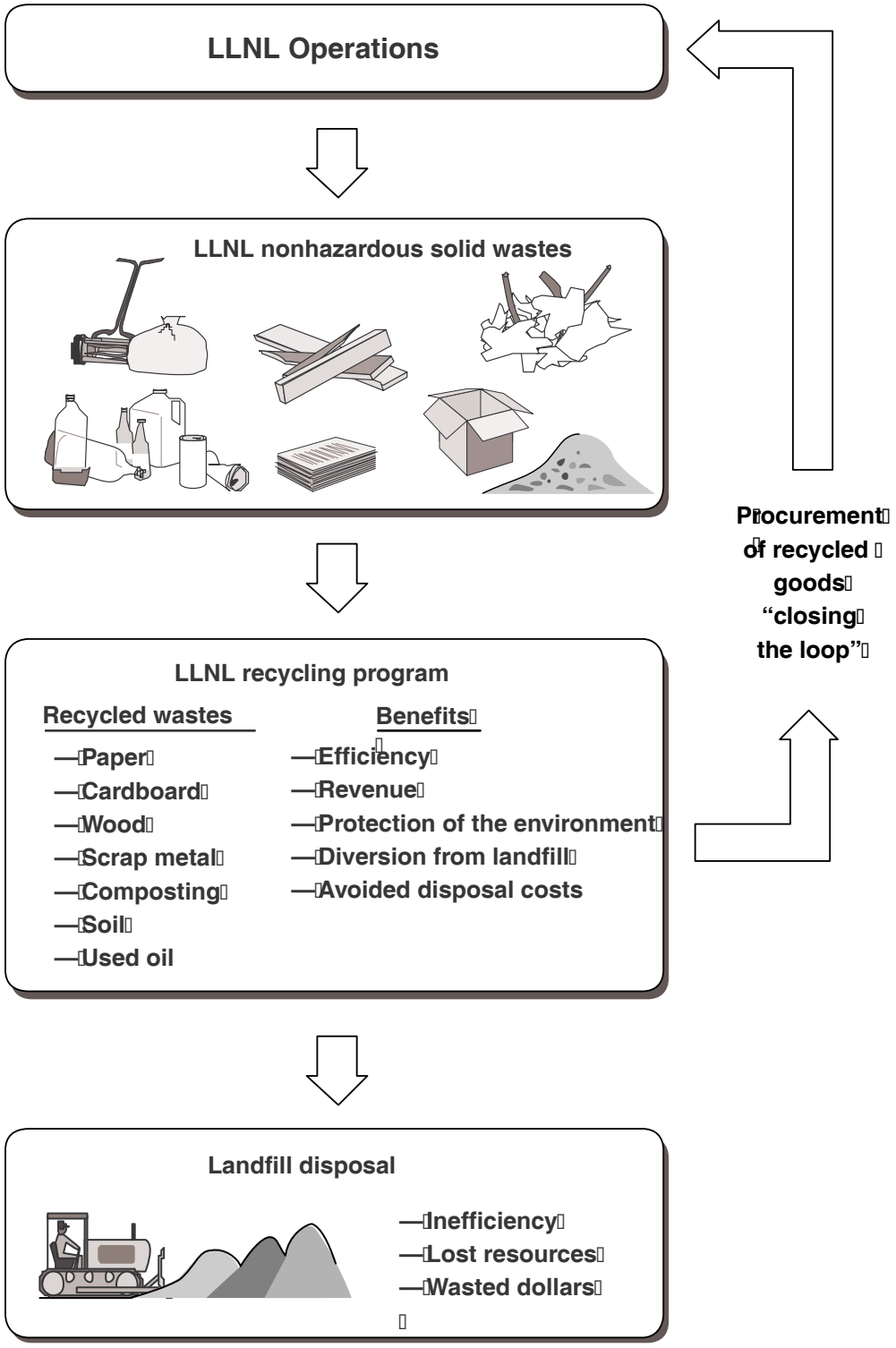

Figure 2. LLNL nonhazardous solid waste minimization programs.

3.0 Responsibilities

All workers and organizations responsible for waste minimization and pollution prevention shall refer to Document 2.1, “Laboratory and ES&H Policies, General Worker Responsibilities, and Integrated Safety Management,” in the *Environment, Safety, and Health (ES&H) Manual* for a list of general responsibilities. Specific responsibilities are listed below each title.

The responsibilities for program/support personnel are outlined below.

As part of LLNL’s comprehensive ES&H effort, LLNL programs and support organizations are responsible for integrating pollution prevention strategies into their respective program and operational activities. Directorates are to track their waste generation using available data provided to them by the Environmental Protection Department (EPD) and implement methods to further reduce waste generation, as appropriate. Specific attention will be given to meeting the ES&H performance measures in Contract 48.

Responsible Individuals of projects involving the use of chemicals are encouraged to recommend the use of the Chemical Exchange Warehouse (CHEW) to all those participating in their projects. CHEW is a service that promotes waste minimization and results in considerable savings by reducing the amount of new chemicals that need to be purchased as well as reducing costs of hazardous waste disposal. When programs shut down, employees retire, or inventories are reduced, many usable chemicals are sent to CHEW, which is managed by the Radioactive and Hazardous Waste Management (RHWM) Division of EPD, for reuse. Unused chemicals can represent a substantial portion of RHWM waste, so CHEW is a valuable waste avoidance program.

Each LLNL employee shall work within his or her line organization, with assistance from its EPD pollution prevention representative and its ES&H Team, to identify and develop waste minimization alternatives.

LLNL employee**s** are encouraged to submit all waste minimization recommendations to their supervisors both for possible adoption and to ensure that waste reduction accomplishments are recorded and recognized.

The specific responsibilities of EPD are outlined below.

EPD Operations and Regulatory Affairs Division (ORAD), Pollution Prevention staff in the Permits and Regulatory Affairs Group (PRAG), at LLNL is responsible for the reporting of pollution prevention activities to DOE and state and federal agencies. Examples of these reports are the Biennial Report, DOE quarterly and annual reports, and SB 14 reports. The waste minimization certifications on manifests are signed by LLNL EPD staff.

In addition, to assist directorates in tracking their waste generation, ORAD provides monthly printouts from the HazTrack. This database includes hazardous, mixed, radioactive, and nonhazardous wastes that are handled by RHWM.

The Pollution Prevention staff specialists of EPD also identify opportunities to reduce pollution, provide technical guidance on pollution prevention projects, and assist in the selection and design of waste-reduction technologies and equipment needed. The Pollution Prevention staff specialists' involvement is triggered by requests from the funding LLNL program or support organization funding manager.

4.0 Work Standards

4.1 Work Smart Standards

CA Health & Safety Code §§ 25244.12-25244.24, Hazardous Waste Source Reduction and Management Review Act of 1989.

14 CCR §§ 17301-17345, Solid Waste Storage & Removal Standards.

22 CCR §§ 66262.10-66262.89, Standards Applicable to Generators of Hazardous Waste.

40 CFR 243, Guidelines for the Storage and Collection of Residential, Commercial, and Institutional Solid Waste.

40 CFR 246, Source Separation for Materials Recovery Guidelines.

40 CFR 247, Comprehensive Procurement Guideline for Products Containing Recovered Materials.

40 CFR 264.75, Biennial Report [Waste Minimization Requirements for Permitted Facilities].

40 CFR 265.75, Biennial Report [Waste Minimization Requirements for Interim Status Facilities].

40 CFR 372, Toxic Chemical Release Reporting: Community Right-To-Know.

DOE Order 5400.1, Chapter III, Paragraphs 4(b) and 4(c)

EO 12856, Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirement (August 3, 1993).

EO 13101, Greening the Government through Waste Prevention, Recycling, and Federal Acquisition (Sept. 14, 1998).

42 USC §§ 13101-13109, Pollution Prevention Act of 1990.

4.2 Other Sources

22 CCR §§ 67100.1-67100.14, Waste Minimization.

5.0 Resources for More Information

5.1 LLNL Contacts

Each LLNL organization is encouraged to work within its program, with assistance from its EPD pollution prevention representative and its ES&H Team, to identify and develop waste minimization alternatives in an effort to reduce hazardous wastes and comply with applicable laws and save on disposal costs. These measures can be relatively simple. For example, before purchasing new chemicals from a commercial supplier or manufacturer, review the CHEW inventory database for excess chemicals free of charge. For more information about CHEW, talk to your RHWM field technician or contact them on the CHEW telephone number available on the ES&H Contact Page.

It is important to discuss any increases, decreases, or other substantial changes (i.e., new projects, demolition, lab closeouts, etc.) in hazardous waste generation and management at your operation with EPD staff. The principal point of contact responsible for pollution prevention guidance within EPD is the pollution prevention representative. The supporting ES&H Team environmental analyst can provide the name and telephone number of this representative for each area. Additionally, each organization's representative on the Waste Minimization Steering Committee can be contacted for assistance in integrating the development and implementation of pollution prevention measures within programmatic activities.

Issues, concerns, and recommendations that you may have regarding nonhazardous waste generation, recycling, and disposal should be forwarded to the Environmental Protection Department, Pollution Prevention Staff at:

- The *EARTH HOTLINE*: 42-EARTH (423-2784).
- The ES&H Team environmental analyst assigned to your area.
- Your organization's representative on the Waste Minimization Steering Committee.

If you have questions or materials that might be used to benefit the waste reduction efforts of LLNL or other agencies, please contact DUS at

http://www.llnl.gov/dus/dus.html

Appendix A

Descriptions of the Work Smart Standards

Descriptions of the Work Smart Standards from Section 4.1 are detailed below.

40 CFR 264.75, Biennial Report [Waste Minimization Requirements for Permitted Facilities]

The Hazardous and Solid Waste Amendments of 1984 (HSWA), which amends the Resource Conservation and Recovery Act (RCRA), requires hazardous waste generators to certify on their hazardous waste shipping documents that they have waste minimization programs in place and to report on the progress of their programs in their biennial reports to the EPA or state-delegated agency formed to meet the requirements of the RCRA. In California, the California Department of Toxic Substances Control (DTSC) has been delegated the RCRA program. Owners and operators of permitted hazardous waste treatment, storage, and disposal facilities (such as LLNL) must also make the same waste minimization certification annually as part of their facility operating records. Details can be found in 40 Code of Federal Regulations (CFR) 264.75, Biennial Report [Waste Minimization Requirements for Permitted Facilities]; and 40 CFR 265.75, Biennial Report [Waste Minimization Requirements for Interim Status Facilities].

40 CFR 247, Comprehensive Procurement Guideline for Products Containing Recovered Materials

EPA established guidelines to assist procuring agencies in complying with the requirements of Section 6002 of RCRA as it applies to procuring items that are or can be made with recovered materials. These guidelines meet the requirements in RCRA to remove exclusions within an agency's procurement process from purchasing recovered materials or using only virgin materials and to establish affirmative procurement programs. Details of the EPA guidelines are found in 40 CFR 274.

42 USC §§ 13101-13109, Pollution Prevention Act of 1990 (PPA)

The PPA also places minimization requirements on private and governmental facilities that emit toxic chemicals and generate hazardous wastes. Facilities that manufacture, process, or otherwise use certain chemicals must report annual chemical releases under earlier legislation, Section 313 of the Superfund Amendment and Reauthorization Act (SARA), Emergency Planning and Community Right-to-Know Act (EPCRA). The SARA 313 "Form R" report used in this process details annual estimates of wastes reduced through source reduction, recycling, and treatment. The forms require reporting on four consecutive years of waste minimization activities for each chemical involved to show success or failure in reducing chemical releases to the environment.

EPCRA reporting requirements and the PPA require facilities to submit chemical-specific information on waste reduction activities, including an estimate of the amount of hazardous waste eliminated through source reduction measures, onsite and offsite recycling, and treatment processes. This information must be summarized and submitted to the EPA annually,

on or before July 1. Applicable regulations are included in 40 CFR 372. EPD takes care of this reporting.

Executive Order (EO) 12856, Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirement (August 3, 1993)

This executive order directs all federal agencies to develop goals to reduce by 50 percent their total releases to the environment and their offsite transfers for treatment and disposal of toxic chemicals regulated under the EPCRA by December 31, 1999. In addition, each federal agency must review its specifications and standards and identify opportunities to eliminate or reduce the use of toxic chemicals. Further, each agency and each facility within that agency required to comply with EPCRA Section 313 must have a plan with goals to eliminate or reduce the unnecessary acquisition of products containing toxic chemicals.

DOE's Pollution Prevention Strategy. As required by Executive Order 12856, the Secretary of Energy issued this document on December 28, 1994, to be implemented by all departmental elements. This document establishes pollution prevention as DOE's primary strategy to reduce the generation of all waste streams and thereby minimize the impact of departmental operations on the environment, reduce operational costs, and improve energy efficiency and safety.

Executive Order 13101, Greening the Government through Waste Prevention, Recycling, and Federal Acquisition (September 14, 1998)

This executive order replaced the five-year-old executive order 12873, Federal Acquisition, Recycling, and Waste Prevention. Executive Order 13101 requires the consideration of pollution prevention and life-cycle analysis in the development of plans, drawings, work statements, and specifications. It also allows the use of "multi-media" EPA inspections of federal facilities, including compliance with this order. (The administrator of the EPA was given six months from the issue date of this executive order to prepare guidance "for use in determining Federal facility compliance with section 6002 of RCRA and the related requirements of this order.") This executive order also requires that all federal facilities develop and implement active recycling and solid waste reduction programs. Federal regulations implementing RCRA Subtitle D, which governs the management of solid wastes, require that federal facilities implement recycling programs for office paper and newspaper. Additionally, RCRA Subtitle F sets guidelines for federal facilities to purchase recycled materials and for source-separating of recyclable materials.

As required by Executive Order 13101, the Secretary of Energy, on November 12, 1999, issued a memorandum stating DOE's "Pollution Prevention and Energy Efficiency Leadership Goals for Fiscal Year 2000 and Beyond." Milestones are also established for the years 2005 and 2010 for all the Program Secretarial Offices to implement at their sites. These pollution prevention goals are DOE's primary strategy to reduce the generation of all waste streams, reduce energy consumption, improve fuel efficiency, reduce air releases, and increase purchases of items made from recycled materials. The objective is to thereby minimize the impact of departmental

operations on the environment, reduce operational costs, and improve energy efficiency and safety. DOE is currently drafting a strategic plan to implement Executive Order 13101.

DOE Order 5400.1, Chapter III, Paragraphs 4(b) and 4(c)

This document requires the preparation of a document, the *Pollution Prevention Awareness Program Plan,* for pollution prevention. This plan must be reviewed annually and updated every three years. Plans for both the Livermore site and Site 300 were first submitted to DOE Headquarters in 1994, and updated in April 1997.

CA Health & Safety Code §§ 25244.12-25244.24, Hazardous Waste Source Reduction and Management Review Act of 1989

This act, referred to as "Senate Bill 14," requires facilities that generate large amounts of hazardous waste to report on the progress of waste minimization activities, changes in waste management activities, and evaluation of waste reduction alternatives every four years.

A facility must generate more than 26,400 pounds (12,000 kg) of hazardous waste, or 26 pounds (12 kg) of extremely hazardous waste each year to be subject to SB 14. The evaluations address waste streams that represent 5 percent or more of the total hazardous waste generated annually by a facility. The progress report and plans must be kept at the facility and need not be submitted, unless requested by the public or the DTSC.

California's SB 14 regulations require that facilities such as LLNL prepare both a baseline waste generation report and a plan for long-term waste reduction every four years. These are kept at LLNL and are available upon request. A recent modification to SB 14 requires the submittal of a summary progress report to DTSC using the same timeline as for the report and plan.

In California, the Integrated Waste Management Act of 1989 (Assembly Bill 939) requires cities and counties throughout the state to develop plans for reducing the amount of solid waste entering landfills each year. Using 1990 as a baseline year, this act established landfill diversion goals of 25 percent by the year 1995, and 50 percent by 2000. It additionally requires cities and counties to submit plans called Source Reduction and Recycling Elements (SRREs) to the state outlining how these diversion goals will be met.

AB 939 also includes a structure of fines for cities and counties that do not make an effort to comply.

14 CCR §§ 17301-17345, Solid Waste Storage & Removal Standards

California's Medical Waste Management Act establishes a comprehensive program for regulating the management, transport, and treatment of medical wastes that are hazardous because they contain infectious agents, biohazardous materials, body tissues or parts, or chemotherapeutic drugs. The medical waste program was originally created by enabling legislation in 1990—California Assembly Bill 109 (AB 109) and California Assembly Bill 1641 (AB 1641)—that enacted Chapter 6.1 in Division 10 of the H&SC. The act is currently located in H&SC Section Division 104, Environmental Health, Part 14, Medical Waste, Sections 117600–

118360. The act requires the registration of large-quantity medical waste generators, transport of medical wastes by registered hazardous waste haulers (except when a small-quantity exemption applies), and operating permits for treatment facilities such as incinerators and steam sterilization units and specifies methods for storing medical waste and treating it so it may be handled as solid waste. The act is administered by the DTSC and is enforced either by the DTSC or by local jurisdictions that elect to implement the program.

22 CCR §§ 66262.10-66262.89, Standards Applicable to Generators of Hazardous Waste

The Department of Toxic Substances Control in the California Environmental Protection Agency (DTSC) regulates management and reduction of hazardous wastes in California. Transportation waste manifests used in California include a waste minimization certification signed by responsible generating facility personnel. The California Code of Regulations (CCR) Title 22, Section 66262.20 and its Appendix includes the specific requirements for hazardous waste manifests. Similarly, DTSC regulates the preparation and submittal of hazardous waste biennial reports on the effectiveness of the hazardous waste generator's waste minimization programs.